ALBERTA OIL SANDS INDUSTRY QUARTERLY UPDATE

SPRING 2016

Reporting on the period:
January 16, 2016 to March 10, 2016

All about the oil sands

Background of an important global resource

Canada has the third-largest oil reserves in the world, after Saudi Arabia and Venezuela. Of Canada's 173 billion barrels of oil reserves, 170 billion barrels are located in Alberta, and about 168 billion barrels are recoverable from bitumen. This is a resource that has been developed for decades but is now gaining increased global attention as conventional supplies—so-called "easy" oil—continue to be depleted. The figure of 168 billion barrels of bitumen represents what is considered economically recoverable with today's technology, but with new technologies, this reserve estimate could be significantly increased. In fact, total oil sands reserves in place are estimated at 1.8 trillion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, which is located in the province's northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is Fort McMurray. The second-largest oil sands deposit is referred to as Cold Lake, just south of Athabasca, with the main population centre the City of Cold Lake. The smallest oil sands deposit is known as Peace River, which is located in northwest-central Alberta. A fourth deposit called Wabasca links to the Athabasca and is generally lumped in with that area.

The existence of bitumen in Alberta has been known for a long time. The first mention of it in Canadian history was in 1719, when a Cree named Wapasu brought a sample of the "gum" to a Hudson's Bay trading post. First Nations in what is now the Wood Buffalo area had traditionally used the bitumen, which seeps from outcrops along the Athabasca River, to waterproof their canoes.

For the first time in 2012, in situ oil sands production exceeded mined oil sands production in Alberta. In 2014, 58 per cent of the province's oil sands volumes were produced using in situ methods. Alberta will continue to rely to a greater extent on in situ production in the future, as 80 per cent of the province's proven bitumen reserves are too deep under ground to recover using mining methods.

There are essentially two commercial methods of in situ (Latin for "in place," essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam is left to soak in the reservoir for a period, melting the bitumen, and then the same wells are switched into production mode, bringing the bitumen to the surface.

In steam assisted gravity drainage (SAGD), parallel horizontal well pairs are drilled from well pads at the surface. One is drilled near the top of the target reservoir, while the other is drilled near its bottom. Steam is injected into the top well, a steam chamber forms, and the melted bitumen flows into the lower well via gravity and is pumped to the surface using artificial lift.

Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The selection is based on a number of factors, including geology. The technologies combined currently produce just over one million barrels per day.

Research is underway on a number of other production technologies designed to optimize production, including variations on solvent-assisted SAGD and CSS, recovery using electricity and in situ combustion.

Bitumen that has not been processed, or "upgraded," can be used directly as asphalt. It must be diluted to travel by pipeline. Adding value, some producers upgrade their product into synthetic crude oil, which is a refinery feedstock. That can be transformed into transportation fuels and other products. ■

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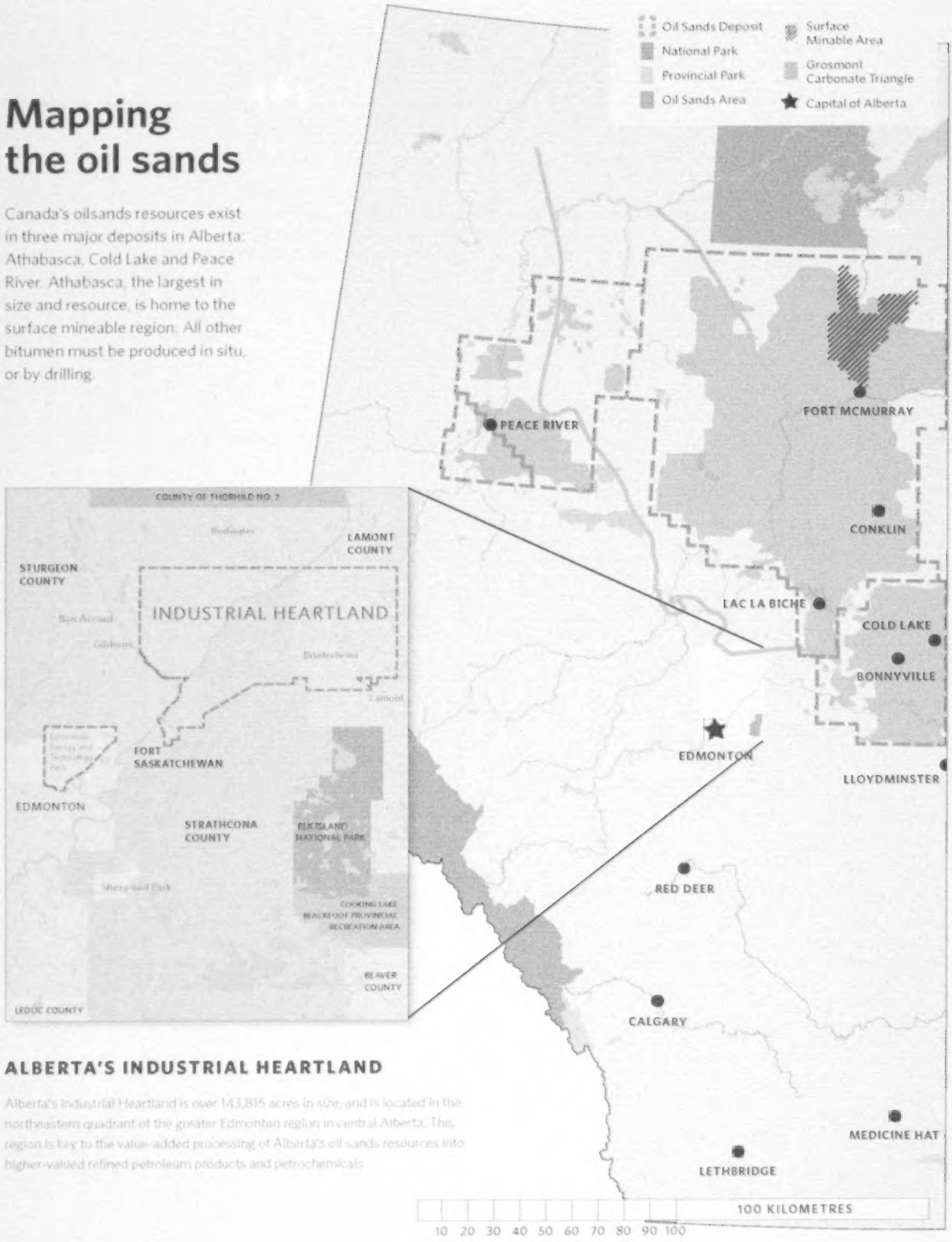
Mapping the oil sands

Canada's oilsands resources exist in three major deposits in Alberta: Athabasca, Cold Lake and Peace River. Athabasca, the largest in size and resource, is home to the surface mineable region. All other bitumen must be produced in situ, or by drilling.



ALBERTA'S INDUSTRIAL HEARTLAND

Alberta's Industrial Heartland is over 143,815 acres in size, and is located in the northeastern quadrant of the greater Edmonton region in central Alberta. This region is key to the value-added processing of Alberta's oil sands resources into higher-valued refined petroleum products and petrochemicals.

GOVERNMENT UPDATE | Alberta Government

PREMIER NOTLEY'S STATEMENT ON ALBERTA NEB SUBMISSION SUPPORTING TRANS MOUNTAIN PIPELINE

In mid-January, Premier Rachel Notley wrote to the National Energy Board in support of Kinder Morgan's proposal to expand capacity of its Trans Mountain Pipeline transporting Alberta crude to the B.C. coast for export.

"Our government believes this project is good for Albertans and good for all Canadians. It will create jobs, spur economic growth, and help fund our province's transition to a greener, less carbon-intensive economy on many levels," Notley said.

"There is significant interest in this project. Our colleagues in British Columbia have restated their position that they want their five conditions met before they will lend their support to this pipeline expansion.

"We encourage Kinder Morgan to continue working with the federal government and the government of British Columbia on these issues. I believe there is a path forward for this pipeline to get approved, but this path forward is not the same failed path Conservative governments have chosen and continue to choose.

"We will not get pipelines built by picking fights with other provinces through the media. And we will not get pipelines built by refusing to take action against global warming. We will get pipelines built by working collaboratively with other jurisdictions and having drama-free discussions about pipelines based on their merits."

Notley said that Alberta's recently announced climate leadership plan will help the province realize new market access projects for the oil industry.

"Our climate leadership plan gives Alberta the opportunity to show the world that we can combat climate change while also protecting the good, mortgage-paying jobs of our oil and gas industry."

HISTORICALLY LOW OIL PRICES AND DECLINING REVENUE IMPACTING THIRD-QUARTER RESULTS

Alberta faces a significant budget shortfall as oil prices continue to collapse to the lowest levels in more than a decade, causing a substantial hit to government revenue.

The oil price collapse has significantly impacted Alberta's resource and personal income tax revenue streams. Prudent financial management, including the re-profiling of some projects and bringing expenses in line with the province's new economic reality, has helped the province mitigate some of the effects of the oil price shock this fiscal year.

Total revenue for 2015-16 is forecast to be $43.1 billion. This is $660 million lower than estimated in the 2015 budget, due primarily to a reduction of $762 million in personal income tax revenue and a $294-million net decrease to resource revenue. Total expense is forecast to be $49.4 billion to $463 million lower than anticipated at budget.

CLIMATE LEADERSHIP PLAN WILL PROTECT ALBERTANS' HEALTH, ENVIRONMENT AND ECONOMY

Alberta's Climate Leadership Plan accelerates the transition from coal-fired power plants to more renewable energy and natural gas power, puts a price on carbon pollution for everyone and sets emissions limits for the oil sands.

Other measures include broad programs to improve energy efficiency, support green technological innovations, reduce methane, and provide support to protect families and small businesses.

The plan is based on the advice of the Climate Change Advisory Panel, led by Andrew Leach, which heard from thousands of individual Albertans and stakeholder groups this fall.

On the advice of leaders from our energy industry and from civil society, the government will legislate an overall oil sands emissions limit of 100 megatonnes, reducing carbon output per barrel, with provisions for new upgrading and co-generation. The government will also phase out pollution created by coal-fired electricity generation by 2030 and will implement a new methane reduction strategy.

One hundred per cent of proceeds from carbon pricing will be reinvested in Alberta, either invested directly into pollution-reducing measures such as clean-energy research, or invested in an adjustment

fund that will help individual families and small businesses.

JOINT STATEMENT BY THE PRIME MINISTER OF CANADA AND THE PREMIER OF ALBERTA

In early February, Prime Minister Justin Trudeau and Premier Rachel Notley issued the following joint statement after their meeting in Edmonton:

"Canada works best when we all work together. Albertans are proud Canadians who have contributed enormously to the economic and social fabric of our country, and Canadians want to be there for Albertans in challenging times."

The three main areas of federal-provincial cooperation cited are jobs and the economy, clean growth and climate change, and energy infrastructure and market access.

The federal government is committed to fast-tracking infrastructure to support Alberta's long-term needs and create short-term jobs. "In addition," said the statement, "in response to a request from Alberta, the Government of Canada stands prepared to provide up to $250 million to the province in the form of an advance fiscal stabilization payment as a result of losses in natural resource revenue."

Both governments recognized that growing Canada's economy to attract investment and create jobs goes hand in hand with combatting climate change. The upcoming First Ministers' meeting looks to establish a pan-Canadian framework for reducing emissions.

The prime minister and premier pointed to Alberta's work in introducing its Climate Leadership Plan, which means "conversations about pipelines are now easier to have."

"We agreed that we must get these resources to market in responsible, sustainable ways that Canadians trust, based on robust environmental assessments and that contribute to greater investment and long-term economic growth and job creation."

THRONE SPEECH HIGHLIGHTS SUPPORTS FOR CHILDREN, JOB CREATION AND ECONOMIC DIVERSIFICATION

The Alberta government's spring agenda focuses on investment in children in low-income families, job creation and economic diversification.

A new child benefit plan will help 380,000 children living in low-income households, while government works to create new jobs and opportunities, build on traditional economic strengths, diversify markets and products, and increase accountability and responsible public fiscal management.

Highlights of the Speech from the Throne (full speech found here) include the government's agenda to:

- diversify energy markets;
- pursue a coherent and effective economic strategy;
- invest in a greener, more sustainable economy;
- take a responsible approach to public finances; and
- make democratic reforms to ensure accountability.

Says Premier Rachel Notley, "We are addressing the energy price shock with continued, focused efforts to diversify markets for our energy products with a new pipeline, major investments in infrastructure priorities and economic diversification, and help for families facing immediate hardship. We will do so in partnership with industry, other Canadian governments, Indigenous peoples, municipalities and all Albertans." ■

LABOUR UPDATE

OIL SANDS SECTOR WORKFORCE REQUIREMENTS TO SHIFT FROM GROWTH AND EXPANSION

A shift in Alberta's oil sands sector from growth and expansion to improving the reliability and performance of existing operations will have long-term impacts on the sector's workforce requirements, says a new labour demand outlook.

By 2020, the growth of 5,170 operations workers (up 17 per cent from 2014) and 4,700 ongoing maintenance workers (a 38 per cent increase) will largely offset the decrease of 10,305 (an 84 per cent drop) in on-site construction jobs, according to the PetroLMI study.

The report, *Oil Sands Construction, Maintenance and Operations Labour Demand Outlook to 2020*, estimates that by 2020 a total of 54,145 direct construction, ongoing maintenance and operations workers will be employed in the oil sands sector, a decrease of approximately one per cent over 2015.

The study provides insight into the impact of 2015 spending and production forecasts on longer-term hiring requirements in the oil sands sector.

The oil sands sector delayed, deferred or cancelled a number of projects in 2015, with a 30 per cent reduction from record capital spending of $35.7 billion in 2014, and is not expected to recover before 2020, the report noted. As a result, demand for future on-site construction labour has been significantly reduced with spending focused on completing projects that currently are under construction.

At the same time, however, production from the oil sands sector will continue to grow across mining, in situ and upgrading operations from projects that are either in the late stage of construction or have recently transitioned into operations. "There are always going to be jobs just to keep the plants running," Emma Monaghan, project manager, said in an interview.

Although overall workforce requirements for the oil and gas industry have been severely affected by a reduction in investment, hiring is expected to continue to 2020 as substantial capital has already been invested in large-scale oil sands projects, according to Carol Howes, vice-president of communications and PetroLMI, with Enform.

"What remains to be seen, as on-site construction of major projects winds down towards the latter half of the forecast period, is the impact of lower oil sands capital investment on production and jobs after 2020."

JOB CREATION AND ECONOMIC DIVERSIFICATION A PRIORITY LEADING INTO BUDGET 2016

Economic diversification, job creation and strong family supports dominated the conversation at a recent Budget 2016 town hall hosted by Alberta's premier and finance minister.

Premier Rachel Notley and President of Treasury Board and Finance Minister Joe Ceci spoke with Albertans during the town hall in Fort McMurray and discussed challenges facing the northern Alberta community as the province continues to face the steepest and most prolonged slide in oil prices in recent history. Albertans from across the province also joined the conversation online, where they had the opportunity to ask questions throughout the event.

"Today we heard about the personal impact of sustained low oil prices on Alberta's families. The enormity of this once-in-a-generation challenge is most apparent in communities like Fort McMurray, where economic success is tied so closely with oil development. This underscores the urgency of our efforts to diversify Alberta's economy as part of our economic action plan," Notley said.

Fort McMurray residents were invited to discuss their concerns in person with the premier and the finance minister. They were joined by Albertans who tuned in to the live-streamed broadcast. Discussion from today's event will help inform Alberta's 2016 budget.

"Difficult times continue to lie ahead for the province as we head into Budget 2016. Our government has a plan to help Albertans weather the storm by deploying all the tools at our disposal, including aggressive infrastructure investment, making capital available to small- and medium-sized businesses through ATB Financial and using the Heritage Fund to invest in Albertans and their jobs," Ceci said. ■

WHAT'S NEW IN THE OIL SANDS

BUSINESS

Alberta is moving in a positive direction on market access thanks to a suite of new climate policies from the provincial government, according to a manager with the Canadian Association of Petroleum Producers (CAPP). The province's improving environmental image on the global stage does not necessarily resolve local opposition to pipelines, however.

"From our perspective, particularly at a national or global perspective, folks are viewing Alberta differently. This initiative does position Alberta in a different lens," said Ben Brunnen, CAPP's manager of fiscal and economic policy. "Folks definitely appreciate Alberta's perspective, but there still needs to be some level of engagement or shift in how we're approaching these issues locally."

Two workers were killed following an explosion in December in the hydrocracker unit of the bitumen upgrader at the Long Lake SAGD project. Long Lake owner Nexen says the upgrader has been shut down and bitumen production has been reduced to minimum rates. An investigation is underway.

CAPP is forecasting total Canadian capex spending in 2016 at $40 billion: $20 billion in the oil sands and $20 billion for the rest of the oil and gas industry. This total spend is half of what it was in 2014 at $81 billion.

Historically, $20 billion in oil sands capex is more than was spent in 2010, more than in 2008, 2007 and almost double what was spent in the downturn of 2009, according to CAPP data. Why this downturn feels so bad—beyond the human toll in more than 60,000 layoffs and the hobbled long-term oil sands industry growth projection—is the growing consensus that more pain is yet to come.

Suncor Energy is promising to improve reliability at the Syncrude joint venture by investing more resources and working more closely with its operator, ExxonMobil Corporation, following its successful bid to acquire part owner Canadian Oil Sands Limited (COS).

The $4.2-billion acquisition increases Suncor's Syncrude ownership from 12 to 49 per cent.

"You put a certain amount of resource in when you're a 12 per cent owner; you put a very different amount of resource in when you're a 49 per cent shareholder," said Steve Williams, Suncor president and chief executive officer.

Williams said Suncor has a great deal of respect for Exxon's capability and has no plans to replace Exxon as operator.

"I think we will be able to offer them some real assistance, and we've started to talk to them about that possibility."

In light of low commodity prices, Connacher Oil and Gas is reducing production at its Great Divide SAGD project. Average production for the month of January is expected to be 7,000–8,000 bbls/d. February and March production is expected to be 3,000–4,000 bbls/d. Both plants at Great Divide will remain operating the majority of this time, and equipment maintenance is ongoing.

Based on field estimates, Connacher's Great Divide production for Q4 2015 averaged roughly 13,900 bbls/d.

Commercial well pairs at the Lindbergh SAGD project are tracking similar to its pilot wells while type curves for the pilot well pairs' actual production continue to exceed expectations, Pengrowth Energy reports.

Steaming at the 12,500-bbl/d project began in December 2014.

Pengrowth says it expects the recovery factor from the commercial well pairs to be virtually identical to the pilot well pairs.

Lindbergh exited 2015 at 15,100 bbls/d, just short of the 16,000 bbls/d the company expected to reach by year-end. ■

WHAT'S NEW IN THE OIL SANDS

TECHNOLOGY

■ Cenovus Energy says it is testing surface and downhole technologies that could reduce SAGD costs by 30 per cent.

Downhole improvements alone are expected to bring finding and development costs to single digits from about $12–$13/bbl over the next three to five years.

The company says it has been able to reduce about 40–50 per cent of the metal on drilling pads on "zero-based modules" that will start operating this year.

Additionally, the company says that new reservoir management techniques it has been working on over the past couple of years to improve wellbore conformance and well productivity at the Foster Creek SAGD project have yielded excellent results.

These enhancements, which include downhole instrumentation and optimization work, as well as steam circulation start-up on new pads, have reportedly increased wellbore conformance at Foster Creek to approximately 90 per cent from between 70 and 75 per cent previously.

■ New technologies to make the oil sands sector carbon competitive need to be commercialized much more quickly, says a retired Suncor executive.

Gord Lambert, Suncor's former executive adviser, sustainability and innovation, says that it takes about 13 years from the time a new technology is conceived until commercial availability.

"We can't afford that type of cycle time in this business world nowadays. We have to make that much, much shorter—which means bolder effort," Lambert says.

"It's a technology development problem; not a technology deployment problem.

"In other words, we don't have the successor to SAGD.... There's some really exciting pilots being developed currently to try and develop that next generation of 'SAGD technology' that would be dramatically less energy intensive. But we don't have that just yet."

Lambert believes Alberta's new carbon policy will help the oil sands industry. While Alberta has some clean oil sands technology funding now, Lambert believes the carbon levy that will be collected by the province offers "even greater capacity to fund [a] collective technology development effort [which] is going to be mission critical for the province."

■ Nsolv has been awarded $13 million in grant funding from Sustainable Development Technology Canada to commercialize its warm solvent in situ bitumen extraction technology.

The technology is designed to reduce greenhouse gas (GHG) emissions by lowering the amount of energy needed to remove heavy oil from the ground. Nsolv says its process uses zero water and very little natural gas to heat the solvent, resulting in an 80 per cent reduction in GHG emissions compared to existing extraction methods.

The company says it is in discussions with a major oil producer to jointly develop a commercial project.

■ Three oil sands producers are exploring whether fuel cells could simultaneously separate CO_2 from a flue gas stream and generate electricity.

Cenovus Energy is the lead partner of a joint industry project with Devon Energy, Royal Dutch Shell, the University of Calgary and Alberta Innovates, the Alberta government's research agency.

The project is intended to quantify the benefits of using fuel cells to separate CO_2 from the flue gas of SAGD steam generators. The first pilot would be at the 14-megawatt, natural gas–fired heat-and-power plant on the university's main campus. Cenovus says the partners expect to make a decision by fall about whether to proceed. ■

OIL SANDS PRODUCTION DATA

Alberta oil sands production by extraction method

*Mining production data for the fourth quarter of 2025 not available at time of publishing

Alberta crude bitumen and synthetic crude production

OIL SANDS TECHNOLOGY LEGEND

AOC (Upgrading) Accelerated decarbonization

AWAG Air injection

C & SC Cyclic and solvent cyclic

CCC (Upgrading) Combustion/fluidized cracking

C-SAGD Cyclic steam-assisted gravity drainage

CSS Cyclic steam stimulation

CSE/EH Ethanol or solvent extraction by separating electromagnetic heating

CT-DSP Cyclic thermal dynamic chipping

HCSS Horizontal cyclic steam stimulation

HTL Heavy to light upgrading process

In situ Production technology undertaken in well via drilling and enhanced recovery

LP-SAGD Low pressure steam-assisted gravity drainage

Mining Truck and shovel mining

Nsolv Nsolv condensing solvent extraction technology

Osum Osum upgrading process

SAGD Steam-assisted gravity drainage

SAP Solvent aided process

SC-SAGD Solvent cyclic steam-assisted gravity drainage

TASD Thermal assisted gravity drainage

THAI Toe to heel air injection

UPG Upstream upgrading

VAP (Upgrading) Ultra selective paraffin

VSD Vertical steam drive

PROJECT LISTINGS [illegible]

Updated status of oil sands projects in Alberta | As of March 2016

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NORTH ATHABASCA REGION — MINING				
Canadian Natural Resources Limited				
Horizon				
Two mid-up oil Horizon Phase 1B is capped for Oct. 2016 and will add 40,000 bbl/d of production capacity. Phase 2 is currently on schedule and budget with start-up in Q4 2017.				
Phase 1	135,000	2008	Operating	Strong
Reliability - Subs for 2	5,000	2016	Operating	Strong
Phase 2A	10,500	2016	Operating	Strong
Phase 2B	45,000	2016	Construction	Strong
Phase 3	80,000	2017	Construction	Strong
Imperial Oil Limited				
Kearl				
Imperial says that Kearl Initiative production averaged 110,000 bbl/d in Q1. The company also reports that it continued strong performance from the Aspaterra project and optimization efforts at the combined Kearl operations.				
Phase 1	110,000	2013	Operating	Strong
Phase 2	110,000	2015	Operating	Strong
Phase 3	80,000	TBD	On Hold	Strong
Phase 4 Debottleneck	35,000	TBD	On Hold	Strong
Shell Athabasca Canada				
Jackpine				
Phase 1A	100,000	2010	Operating	Strong
Phase 1B	100,000	TBD	Approved	Strong
Expansion	100,000	TBD	Approved	Strong
Muskeg River				
Project partner Marathon Oil says that record production of approximately 190,000 bbl/d during Q1 was largely due to improved operational reliability and no planned maintenance.				
Commercial	155,000	2002	Operating	Strong
Expansion 1 Debottlenecking	115,000	TBD	Approved	Strong
Pierre River				
Shell has withdrawn its application for the Pierre River project, saying it wants to focus on its existing oil sands operations. The company says it will continue to hold the Pierre River leases and may re-apply in the future.				
Phase 1	100,000	TBD	Cancelled	Strong
Phase 2	100,000	TBD	Cancelled	Strong
Suncor Energy Inc.				
Base Operations				
Suncor says that planned upgrader maintenance was completed in the fourth quarter of 2015. Additionally, upgrader reliability recorded 98 per cent, more than a year ahead of the company's plan.				
Millennium Mine	294,000	1967	Operating	Strong
Steepbank Mine Extension Phase 1	6,000	2015	Operating	Strong
Millennium Debottlenecking	23,000	2008	Operating	Strong
North Steepbank Extension	180,000	2015	Operating	Strong
Fort Hills				
Suncor says that at the end of 2015, construction is more than 70 per cent complete. Spending during the quarter included engineering, procurement, module fabrication and site construction.				
Phase 1	180,000	2017	Construction	Strong
Debottleneck	20,000	TBD	Approved	Strong

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Voyageur South				
Suncor considers Voyageur South to be a "target tuture" project and has not undertaken a start-up date.				
Phase 1	200,000	2028	Announced	Strong
Syncrude Canada Ltd.				
Mildred Lake/Aurora				
In December, Syncrude confirmed it was maintaining regulatory schedule as declared last year (2015). Suncor Energy announced that it will acquire Canadian Oil Sands in early 2016. Upon completion, Suncor will hold a 58.74 per cent interest in Syncrude.				
Base Mine Stage 1 & 2 Expansion	348,700	2578	Operating	Strong
Stage 3 Expansion	116,300	2006	Operating	Strong
Centrifuge Tailings Management	TBD	TBD	Operating	Strong
Aurora South Train 1	100,000	TBD	Approved	Strong
Aurora South Train 2	100,000	TBD	Approved	Strong
Mildred Lake Mine Extension (MLX)	348,000	2025	Application	Strong
Teck Resources Limited				
Frontier				
Teck has filed a project update for the Frontier mining development. The capital cost has been increased by $2B to address past the initial capacity to refer from 200,000 bbl/d. Alberta Environment and Parks says that supplemental information is required regarding the Frontier application and is not made public currently.				
Phase 1a	105,000	2026+	Application	Strong
Phase 1b	85,000	2027	Application	Strong
Phase 2	90,000	2027	Application	Strong
Total E&P Canada Ltd.				
Joslyn North Mine				
Total has withdrawn the regulatory applications for the Joslyn North Mine.				
Phase 1	100,000	TBD	On Hold	Strong
NORTH ATHABASCA REGION — IN SITU				
Athabasca Oil Corporation				
Dover				
Athabasca says Dover is one of its key near assets.				
Phase 1	12,000	TBD	Announced	n/m
Dover West Optimized Cyclics				
Athabasca says Dover West is one of its key near assets.				
Phase 2 Demonstration	6,000	TBD	Approved	n/m
Phase 2 Commercial	6,000	TBD	Application	n/m
Dover West Leads & Pashley				
Athabasca says Dover West is one of its key near assets.				
Phase 1	23,000	TBD	Application	Q4 2
Phase 2	25,000	2019	Announced	n/m
Phase 3	25,000	2020	Announced	n/m
Phase 4	25,000	2021	Announced	n/m
Phase 5	25,000	2022	Announced	n/m
BP p.l.c.				
Terre de Grace				
BP expects to see 2016 that is a pathway that "over its future decade make action before 2020.				
Pilot	10,000	TBD	Approved	n/m

Project / Phase	Capacity	Year	Regulatory Status	Operator
Boreal Energy Cooperative				
Kinbasket				
Kinbasket Commissioning Plant	12,000	2017	Approved	Kinbasket
Kinbasket Phase 1	25,000	2021	Approved	Kinbasket
Kinbasket Phase 2	30,000	2023	Approved	Kinbasket
Kinbasket Phase 3	40,000	2025	Approved	Kinbasket
Kinbasket Phase 4	50,000	2027	Approved	Kinbasket
Kinbasket Phase 5	50,000	2029	Approved	Kinbasket
Muskrat Basin				
Phase 1	20,000	2023	Construction	Kinbasket
Phase 2	40,000	2027	Approved	Kinbasket
Phase 3	40,000	2029	Approved	Kinbasket
Phase 4	25,000	2031	Approved	Kinbasket
Cascades Natural Resources Limited				
Rock Shannon				
Phase 1	45,000	1981	Abandoned	Rock Shannon
Phase 2	45,000	1988	Abandoned	Rock Shannon
Cassiar Energy Co.				
Fort Wolfberry				
Phase 1	24,000	1994	Abandoned	Wolfberry
Greyhawk				
Phase 1	30,000	1991	Abandoned	Greyhawk
Delphinium Lake				
Cancelled. Sale of undeveloped acreage to Greyhawk; permit withdrawn.				
Phase A	60,000	1981	Not Built	Abandoned
Phase B	60,000	1984	Approved	Abandoned
CT Energy Ltd				
Flying Creek				
CT and Sapphire Petroleum split acreage and continue operating as Sapphire. The unit plans steam to install production at the Flying Creek site using a combination of CT and Sapphire's proprietary technology.				
Cogenerational Plant	2,000	2022	Suspended	Sapphire
Brady Oil Sands Ltd				
Thickwood				
The Alberta Energy Regulator says it will defer decisions on applications not to vary oilsands projects in the Lake Athabasca thermal area — of the Shipwreck basin until it has developed further royalty-rate improvements, namely Thickwood's — one of the most-advanced projects.				
Phase 1	6,000	2026	Cancelled	Brady Oil Sands Ltd
Phase 2	6,000	2031	Cancelled	Brady Oil Sands Ltd
Cooky Energy Inc.				
Kabob				
Cooky filed the regulatory application for its Kabob joint in early May 2023.				
Cancelled Plant	5,000	1981	Application	Kabob
Kettle				
Cooky says that Kettle is a hefty-ramping up in-batch injection capacity of about 40,000 bbl/day around the end of 2030.				
Phase 1A	20,000	2023	Operating	Kettle
Phase 1B	20,000	2025	Operating	Kettle
Phase 2A	20,000	2031	Not Built	Kettle
Phase 2B	20,000	2032	Approved	Kettle
Future Phases	70,000	2041	Approved	Kettle
Cygnus Oil Limited				
Rigel				
Cygnus has submitted its regulatory application for Rigel to vary current approval 9823 before Cancelled Unit 1. Rigel is a big project in its execution to be phase of 70,000 bbl/d with development timing subject to regulatory approvals and market conditions. A final investment decision could be made as early as 2027.				
Phase 1	70,000	2029	Application	Cygnus
Phase 2	70,000	2031	Application	Cygnus
Iceline Energy Inc.				
Tyrapark				
Iceline has announced that despite considerable effort by the company, its bonds and major creditors, the pipeline have been unable to reach a viable restructuring proposal under the Netherlands and therefore is the. The company has declared bankruptcy as of [illegible] filed as Case 7.				
Phase 1	20,000	1994	Cancelled	Tyrapark
Phase 2	20,000	1997	Cancelled	Tyrapark
Gold Exploration Fourth Corporation				
Kodiak				
Gold has withdrawn the Chadwick project from the regulatory review process.				
Commercial Demonstration	5,000	2027	Cancelled	Kodiak
Phase 1	30,000	1997	Cancelled	Kodiak
Phase 2	20,000	1997	Cancelled	Kodiak
Abraham Oil Corporation				
Birchbank				
Abraham had gain positive in-country regulatory approval for the Vine Island project by the end of 2019. Upon receiving this approval, the Company will further evaluate its financing model plans.				
Demonstration	10,000	1994	Cancelled	Birchbank
Ice Tree Energy Ltd				
Lotti				
Ice Tree Energy says the Lotti project is well positioned for additional tariff capacity in its operational areas of parts of the.				
Pilot	1,000	1991	Approved	Lotti
Coast Petroleum Ltd				
Egret				
Coast Petroleum plans its regulatory applications for the Egret West project in November 2023. Regulatory approval is expected in the second half of 2024.				
Phase 1	22,000	2027	Application	Egret
Kodiak Hydro Resources Ltd				
Elk Valley				
Kodiak Hydro said certain of its subsidiary coal research mining properties under the subsidiary Kodiak Metallurgical Inc. The Elk Valley is being supported by principal capital asset at seven mines.				
Phase 1	12,000	2021	Suspended	Elk Valley
Kenai Energy Inc.				
Kiwi				
A first independent was that since mid-up to 12/2021. No joint push has produced and 12,000 bpd of oil.				
Bulk Oil Oil Plant	200	2019	Operating	Kiwi
LNG Oil Plant	800	2021	Operating	Kiwi
Phillip				
Kenai says that work at Phillip continues to focus on well pad construction, including pressing production, and has delivered planned supplementary wells. 2022 vs. 2021. Effective Jan. 1, 2021, Kenai has nameplate capacity of Phillip is expected that 184,000 bbl/d vs 2020 as a result of adjustment of Beaufort Bay activities.				
Stage 1	25,000	2007	Operating	Phillip
Stage 2	25,000	2009	Operating	Phillip
Commercial and Experimental	25,000	2017	Operating	Phillip
Stage 3	50,000	2011	Operating	Phillip
Stage 4	50,000	2014	Operating	Phillip
Stage 5	50,000	1991	Approved	Phillip
Stage 6	50,000	1991	Approved	Phillip
Stage 3-5 Debottlenecking	20,000	1991	Operating	Phillip
Lotti				
Phase 1	30,000	1991	Abandoned	Lotti
Phase 2	30,000	1991	Abandoned	Lotti

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Current Project	Capacity	Start-up	Regulatory Status	Technology
Mariana – Thornbury				
FY23 said that the project is preparing for FEED activities.				
Phase 1	20,000	2021	Application	SAGD
Suncap Petroleum (Canada) Co. Ltd.				
Blueboy				
Suncap Petroleum received regulatory approval on January.				
Blueboy Experimental Pilot	700	2025	Approved	Steam & CO_2
Cutout				
Leftover				
Demonstration	10,000	2020	Operating	SAGD
Commercial	50,000	2022	Operating	SAGD
Expansion	35,000	2027	Approved	SAGD
Shuttered	20,000	2024	Shuttered	SAGD
Suncor Energy Inc.				
Chard				
Phase 1	60,000	2027	Announced	In situ
Meadow Creek East				
Jacobs Engineering has been awarded the design basis memorandum contract for the Meadow Creek project, using a split-drive strategy.				
Phase 1	80,000	2029	Approved	SAGD
Phase 2	80,000	2033	Approved	SAGD
Kerrisdale Energy Ltd.				
Whitecourt				
Phase 1	12,000	2030	Application	SAGD
Kelso Creation Inc.				
Advanced Trifoil				
ATS 1	15,000	2031	Application	SAGD
ATS 2	30,000	2037	Application	SAGD
ATS 3	30,000	2041	Application	SAGD
CTD+ (Demonstration of Excellence)				
Kelso Creation has filed an amendment to its regulatory approval to increase production capacity from 1,200 to 2,000 bbl/d.				
Pilot	1,200	2028	Application	SAGD
COLD LAKE REGION — IN SITU				
Eagles Energy Corp.				
Sawtell				
Eagles has made the decision to decommission the Cutbank SAGD pilot due to low oil pricing. The company says that since operations started last year the pilot has successfully captured the key data associated with its objectives. The company's primary objective was to confirm economic production capacity to support a commercial-scale project. Following regulatory approval for the commercial project, any subsequent sanctioning decision will be considered in the context of the project economics at a higher commodity price environment.				
Pilot	1,200	2018	Suspended	SAGD
Commercial	5,000	TBD	Approved	SAGD
Birchwood Resources Inc.				
Sage				
Birchwood has until September 30, 2025 to submit a response to supplemental info pertinent requests related to the Sage regulatory application.				
Pilot	5,000	2027	Cancelled	LP SAGD
Canadian Natural Resources Limited				
Primrose & Wolf Lake				
Canadian Natural says that it continues to progress low-pressure steamflood operations at Primrose East Area 1 as well as low-pressure CSS operations at Primrose East Area 2, and that operations at Primrose East are meeting expectations.				
Wolf Lake	15,000	1985	Operating	CSS
Primrose South	85,000	1985	Operating	CSS
Primrose North	30,000	2006	Operating	CSS
Primrose East	22,000	2008	Operating	CSS
Cenovus Canada Corporation				

Current Project	Capacity	Start-up	Regulatory Status	Technology
Mahihpi				
Cenovus says the Mahihpi project is currently on hold.				
Phase 1	40,000	TBD	Approved	SAGD
Husky Energy Inc.				
Catfish				
Demonstration	10,000	TBD	Approved	SAGD
Tucker				
Husky says that work is continuing to increase production and improve reliability, with a new well pad that will add 5,000 bbl/d to bring production up to 20,000 bbl/d in 2017. Overall, the Tucker at Tucker has averaged about 11,000 bbl/d since the beginning of September 2015.				
Phase 1	30,000	2006	Operating	SAGD
Imperial Oil Limited				
Cold Lake				
Looking ahead, Cold Lake, including Mahihpi, will require streamlining strategies across all assets to enhance resource recovery. Late in 2015 Alberta Environment and Parks issued the final terms of reference for the Mahihpi project, and now awaits the submission of an environmental impact assessment and regulatory application.				
Phase 1 10	110,000	1985	Operating	CSS
Phase 11 12	30,000	2007	Operating	CSS
Experimental SA-SAGD	700	2013	Operating	SA-SAGD
Phase 14 1n	80,000	2021	Operating	CSS
Cold Lake Expansion	50,000	TBD	Announced	SA-SAGD
JACOS Oil Sands Corp.				
Hilda				
JACOS plans to evaluate the approved well pad development sequence at Hilda, delivering two regionally planned pads and leveraging on-site producing pad as well as three new pads to increase production to the approved 35,000 bbl/d.				
Phase 1	10,000	2027	Operating	SAGD
Phase 2	10,000	TBD	Approved	SAGD
Taiga				
JACOS says that Taiga Phase 1 will be advanced on 2021 bc subject to financing.				
Phase 1	12,500	TBD	Approved	CSS SAGD
Phase 2	12,500	TBD	Approved	CSS SAGD
Phase 3	20,000	TBD	Approved	CSS SAGD
Pengrowth Energy Corporation				
Lindbergh				
The 2016 allocation of $14 million of capital to Lindbergh will be diverted to maintain pace activities as well as further pre-engineering and design for the phase two expansion. Pengrowth expects to receive regulatory approval for the expansion phase of Lindbergh in the first half of the year.				
Pilot	1,200	2017	Operating	SAGD
Phase 1	11,240	2019	Operating	SAGD
Phase 1 Optimization	3,500	TBD	Operating	SAGD
Phase 2 Expansion	18,000	TBD	On Hold	SAGD
PEACE RIVER REGION — IN SITU				
Andora Energy Corporation				
Saint Lake				
Project partner Pan Orient Energy says that the demonstration project will be suspended at the end of February 2016 due to the expectation that relatively low bitumen prices may continue for some time, as well as the extended time required for regulatory approval of the 2,500 bbl/d expansion application, which Pan Orient says will be submitted in March 2016. It is reported that a reactivation of the demonstration project would be considered as part of the expansion.				
Demonstration	1,800	2014	Suspended	SAGD
Expansion	2,200	TBD	Announced	SAGD
Baytex Energy Corp.				
Clifftain				
Baytex says that operations at the Clifftain CSS pilot were suspended in late September 2015.				
Pilot	2,000	2013	Suspended	CSS
Conoco				
Southview Exploration Inc. has disposed of its interest in the Clarkson area of Alberta for cash consideration of $7.15 million.				
Experimental Demonstration	TBD	2014	Suspended	CSS

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Harmon Valley				
Pilot	180	2011	Operating	CSS
Murphy Oil Company Ltd.				
Seal/Cadotte				
Murphy Oil says that during Q3, volumes from the Seal area were reduced due to the shut-in of uneconomic wells and environmental monitoring together with natural decline.				
Pilot	780	780	Operating	HCSS
Demonstration	12,450	2015	Application	HCSS
Northern Alberta Oil Ltd.				
Sawn Lake				
Parent company Deep Well Oil & Gas says it is waiting on the preliminary results of the Sawn Lake SAGD pilot operated by Ardera Energy to fine-tune the horizontal cyclic steam project design. Deep Well is a partner on the Sawn Lake project.				
Pilot	200	1981	Approved	HCSS
Penn West Petroleum Ltd.				
Harmon Valley South				
In collaboration with its partner, Penn West has finalized the budget for the second half 2015 and first half 2016 development program in the area. Penn West's management is pleased to have the full support of its partner allowing for development to be accelerated in the play through the addition of a second rig to the program. The second rig is planned to start in September and carry through to the end of the year. Approximately 90 per cent of Penn West's expenditures continue to be paid for by our partner in the PEOP joint venture.				
Pilot	180	2014	Operating	HCSS
Seal Main				
In collaboration with its partner, Penn West has finalized the budget for the second half 2015 and first half 2016 development program in the area. Penn West's management is pleased to have the full support of its partner allowing for development to be accelerated in the play through the addition of a second rig to the program. The second rig is planned to start in September and carry through to the end of the year. Approximately 90 per cent of Penn West's expenditures continue to be paid for by our partner in the PEOP joint venture.				
Pilot	75	2011	Operating	HCSS
Commercial	10,000	180	Application	HCSS
Royal Dutch Shell plc				
Peace River				
Shell has stopped construction of the Carmon Creek project. Shell is reducing the project leases and some equipment as evaluations are ongoing.				
Cadotte Lake	12,500	1986	Operating	CSS
Carmon Creek Phase 1	80,000	180	On Hold	VSD
Carmon Creek Phase 2	80,000	180	On Hold	VSD
NORTH ATHABASCA REGION — UPGRADER				
BP p.l.c.				
Terre de Grace				
BP stated in late 2014 that it is unlikely that Terre de Grace would come online before 2030.				
Pilot	8,800	180	Approved	ADC VSP
Canadian Natural Resources Limited				
Horizon				
The start up of Horizon Phase 2B is targeted for Oct 2016 and will add 45,000 bbl/d of production capacity. Phase 3 is currently on schedule & budget with start up in Q4 2017.				
Phase 1	110,000	2009	Operating	UPG
Solubility Injector 2	5,000	2014	Operating	UPG
Phase 2A	12,000	2014	Operating	UPG
Phase 2B	45,000	2016	Construction	UPG
Phase 3	80,000	2017	Construction	UPG
C.T Energy Ltd.				
Poplar Creek				
C.T and Bapshore Petroleum will merge and continue operating as Bapshore. The com-pany plans to restart production at the Poplar Creek site using a combination of C.T and Bapshore's proprietary technologies.				
Experimental Pilot	180	180	Announced	CCC
Ivanhoe Energy Inc.				

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Tamarack				
Ivanhoe has announced that despite considerable efforts by the company, its bonine and major creditors, the parties have been unable to reach a viable restructuring proposal under the Bankruptcy and Insolvency Act. The company was deemed bankrupt as of 11:59 PM MDT on June 1.				
Phase 1	34,284	180	Cancelled	HTL
Suncor Energy Inc.				
Base Operations				
Suncor says that planned upgrader maintenance was completed in the fourth quarter of 2015. Additionally, upgrader reliability exceeded 90 per cent, more than a year ahead of the company's plan.				
U1 and U2	225,000	1967	Operating	UPG
Millennium Vacuum Unit	35,000	2008	Operating	UPG
Millennium Coker Unit	97,000	2008	Operating	UPG
Syncrude Canada Ltd.				
Mildred Lake/Aurora				
In December, Syncrude performed coker maintenance originally scheduled for mid-2016. Suncor Energy announced that it will acquire Canadian Oil Sands in early 2016; upon completion Suncor will have a 48.74 per cent interest in Syncrude.				
Base Plant Stage 1 & 2 Debottleneck	250,000	1978	Operating	UPG
Stage 3 Expansion (SE 1)	100,000	2006	Operating	UPG
Stage 3 Debottleneck	75,000	180	Announced	UPG
SOUTH ATHABASCA REGION — UPGRADER				
CNOOC Limited				
Long Lake				
A hydrocracker explosion at Long Lake on January 15 resulted in two fatalities. Nexen says its upgrader has been shut down and SAGD volumes have been reduced to minimum rates. No timeline for a full facility restart has been announced, and an AER investigation is underway.				
Phase 1	58,500	2009	Suspended	OilCrete
Value Creation Inc.				
Advanced SCORE				
AFS 1	12,750	180	Application	ADC VSP
AFS 2	25,500	180	Application	ADC VSP
AFS 3	25,500	180	Application	ADC VSP
CCE's (Consolidation of Excel-lence)				
Value Creation has filed an amendment to its regulatory approval to increase production capacity from 1,000 to 6,000 bbls/d.				
Pilot	12,000	2018	Application	ADC VSP
INDUSTRIAL HEARTLAND REGION — UPGRADER				
North West Upgrading Inc.				
Redwater Upgrader				
As the result of an on site pedestrian vehicle incident Dec. 9, 2015, one of NWU's employees was fatally injured. The on site workforce has reached 2,800 people. To date approximately 800 modules have been installed with more than 600 additional modules standing in various stages of assembly at module fabrication shops. Module delivery and assembly into the refinery will continue throughout 2016.				
Phase 1	50,000	2017	Construction	UPG
Phase 2	50,000	180	Approved	UPG
Phase 3	50,000	180	Approved	UPG
Shell Athbasca Sands				
Scotford Upgrader				
Shell has made a final investment decision on the HCU debottleneck project, which is ex-pected to increase hydrocracking capacity by about 20 per cent. Project partner Marathon Oil says that planned turnarounds at the base upgrader and Muskeg River mine were completed on time and on budget in Q2, as well as unplanned downtime at the expansion upgrader.				
Commercial	156,000	2003	Operating	UPG
Expansion	100,000	2011	Operating	UPG
Scotford HCU Debottleneck	14,000	180	Announced	UPG

GLOSSARY of oil sands terms

ASPHALTENES
The heaviest and most concentrated aromatic hydrocarbon fractions of bitumen.

BARREL
The traditional measurement for crude oil volumes. One barrel equals 42 U.S. gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

BITUMEN
Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oil sand, but saturation varies.

COGENERATION
The simultaneous production of electricity and steam, which is part of the operations of many oil sands projects.

COKING
An upgrading/refining process used to convert the heaviest fraction of bitumen into lighter hydrocarbons by rejecting carbon as coke. Coking can be either delayed coking (semi-batch) or fluid coking (continuous).

CONDENSATE
Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid, and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

CONVENTIONAL CRUDE OIL
Mixture of mainly pentane and heavier hydrocarbons recoverable at a well from an underground reservoir, and liquid at atmospheric pressure and temperature. Unlike bitumen, it flows through a well without stimulation and through a pipeline without processing or dilution.

CRACKING
An upgrading/refining process for converting large, heavy molecules into smaller ones. Cracking processes include fluid cracking and hydrocracking.

CYCLIC STEAM STIMULATION (CSS)
An in situ production method incorporating cycles of steam injection, steam soaking and oil production. The steam reduces the viscosity of the bitumen and allows it to flow to the production well.

DENSITY
The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m^3) or degrees on the American Petroleum Institute (API) gravity scale; in western Canada, oil up to 900 kg/m^3 is considered light-to-medium crude—oil above this density is deemed as heavy oil or bitumen.

DILBIT
Bitumen that has been reduced in viscosity through addition of a diluent such as condensate or naphtha.

DILUENT
A light hydrocarbon blended with bitumen to enable pipeline transport. See Condensate.

EXTRACTION
A process, unique to the oil sands industry, that separates the bitumen from the oil sand using hot water, steam and caustic soda.

FROTH TREATMENT
The means to recover bitumen from the mixture of water, bitumen and solids "froth" produced in hot-water extraction (in mining-based recovery).

GASIFICATION
A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy by-products.

GROUNDWATER
Water accumulations below the Earth's surface that supply fresh water to wells and springs.

HEAVY CRUDE OIL
Oil with a gravity below 22 degrees API. Heavy crudes must be blended or mixed with condensate to be shipped by pipeline.

HYDROCRACKING
Refining process for reducing heavy hydrocarbons into lighter fractions, using hydrogen and a catalyst; can also be used in upgrading bitumen.

HYDROTRANSPORT
A slurry process that transports water and oil sand through a pipeline to primary separation vessels located in an extraction plant.

HYDROTREATER
An upgrading/refining process unit that reduces sulphur and nitrogen levels in crude oil fractions by catalytic addition of hydrogen.

IN SITU
A Latin phrase meaning "in its original place." In situ recovery refers to various drilling-based methods used to recover deeply buried bitumen deposits.

IN SITU COMBUSTION
An enhanced oil recovery method that works by generating combustion gases (primarily CO and CO_2) downhole, which then "push" the oil towards the recovery well.

LEASE
A legal document from the province of Alberta giving an operator the right to extract bitumen from the oil sand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

LIGHT CRUDE OIL
Liquid petroleum with a gravity of 28 degrees API or higher. A high-quality light crude oil might have a gravity of about 40 degrees API. Upgraded crude oils from the oil sands run around 30–33 degrees API (compared to 32–34 for Light Arab and 37–40 for West Texas Intermediate).

MATURE FINE TAILINGS
A gel-like material resulting from the processing of clay fines contained within the oil sands.

OIL SANDS
Bitumen-soaked sand deposits located in three geographic regions of Alberta: Athabasca, Cold Lake and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total in-place deposits of bitumen in Alberta are estimated at 1.7 trillion to 2.5 trillion barrels.

OVERBURDEN
A layer of sand, gravel and shale between the surface and the underlying oil sand in the mineable oil sands region that must be removed before oil sands can be mined.

PERMEABILITY
The capacity of a substance (such as rock) to transmit a fluid, such as crude oil, natural gas or water. The degree of permeability depends on the number, size and shape of the pores and/or fractures in the rock and their interconnections. It is measured by the time it takes a fluid of standard viscosity to move a given distance. The unit of permeability is the Darcy.

PETROLEUM COKE
Solid, black hydrocarbon that is left as a residue after the more valuable hydrocarbons have been removed from the bitumen by heating the bitumen to high temperatures.

PRIMARY PRODUCTION
An in situ recovery method that uses natural reservoir energy (such as gas drive, water drive and gravity drainage) to displace hydrocarbons from the reservoir into the wellbore and up to the surface. Primary production uses an artificial lift system in order to reduce the bottomhole pressure or increase the differential pressure to sustain hydrocarbon recovery, since reservoir pressure decreases with production.

RECLAMATION
Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

STEAM ASSISTED GRAVITY DRAINAGE (SAGD)
An in situ production process using two closely spaced horizontal wells: one for steam injection and the other for production of the bitumen/water emulsion.

SURFACE MINING
Operations to recover oil sands by open-pit mining using trucks and shovels. Less than 20 per cent of Alberta's oil sands resources are located close enough to the surface (within 75 metres) for mining to be economic.

SYNTHETIC CRUDE OIL
A manufactured crude oil comprised of naphtha, distillate and gas oil-boiling range material. Can range from high-quality, light sweet bottomless crude to heavy, sour blends.

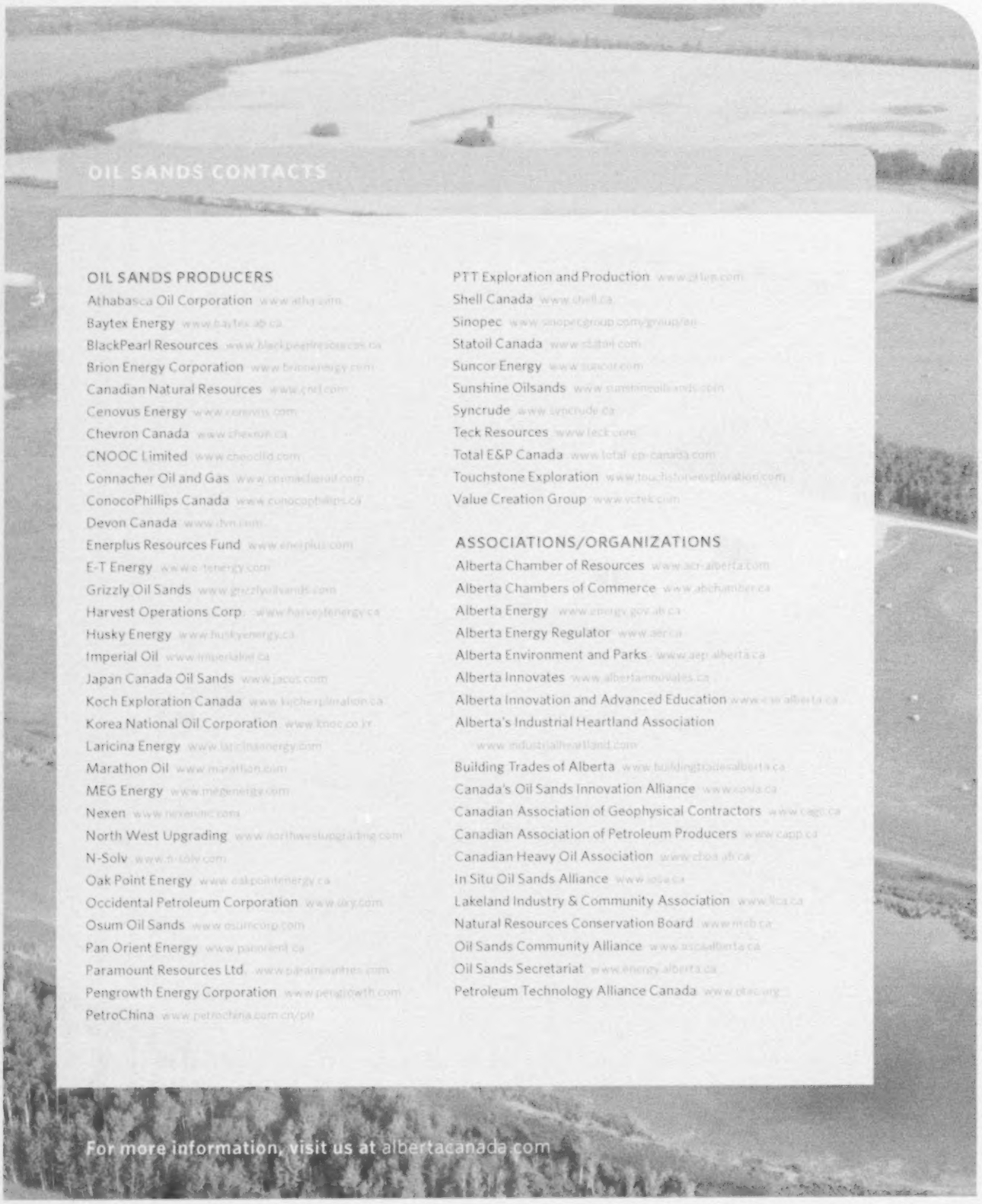
TAILINGS
A combination of water, sand, silt and fine clay particles that is a by-product of removing the bitumen from the oil sand through the extraction process.

TAILINGS SETTLING BASIN
The primary purpose of the tailings settling basin is to serve as a process vessel, allowing time for tailings water to clarify and silt and clay particles to settle so that the water can be reused in extraction. The settling basin also acts as a thickener, preparing mature fine tails for final reclamation.

THERMAL RECOVERY
Any in situ process where heat energy (generally steam) is used to reduce the viscosity of bitumen to facilitate recovery.

UPGRADING
The process of converting heavy oil or bitumen into synthetic crude either through the removal of carbon (coking) or the addition of hydrogen (hydroconversion).

VISCOSITY
The ability of a liquid to flow. The lower the viscosity, the more easily the liquid will flow.



OIL SANDS CONTACTS

OIL SANDS PRODUCERS

Athabasca Oil Corporation www.athx.com
Baytex Energy www.baytex.ab.ca
BlackPearl Resources www.blackpearlresources.ca
Brion Energy Corporation www.brionenergy.com
Canadian Natural Resources www.cnrl.com
Cenovus Energy www.cenovus.com
Chevron Canada www.chevron.ca
CNOOC Limited www.cnoocltd.com
Connacher Oil and Gas www.connacheroil.com
ConocoPhillips Canada www.conocophillips.ca
Devon Canada www.dvn.com
Enerplus Resources Fund www.enerplus.com
E-T Energy www.et-energy.com
Grizzly Oil Sands www.grizzlyoilsands.com
Harvest Operations Corp. www.harvestenergy.ca
Husky Energy www.huskyenergy.ca
Imperial Oil www.imperialoil.ca
Japan Canada Oil Sands www.jacos.com
Koch Exploration Canada www.kochexploration.ca
Korea National Oil Corporation www.knoc.co.kr
Laricina Energy www.laricinaenergy.com
Marathon Oil www.marathon.com
MEG Energy www.megenergy.com
Nexen www.nexeninc.com
North West Upgrading www.northwestupgrading.com
N-Solv www.n-solv.com
Oak Point Energy www.oakpointenergy.ca
Occidental Petroleum Corporation www.oxy.com
Osum Oil Sands www.osumcorp.com
Pan Orient Energy www.panorient.ca
Paramount Resources Ltd. www.paramountres.com
Pengrowth Energy Corporation www.pengrowth.com
PetroChina www.petrochina.com.cn/ptr
PTT Exploration and Production www.pttep.com
Shell Canada www.shell.ca
Sinopec www.sinopecgroup.com/group/en
Statoil Canada www.statoil.com
Suncor Energy www.suncor.com
Sunshine Oilsands www.sunshineoilsands.com
Syncrude www.syncrude.ca
Teck Resources www.teck.com
Total E&P Canada www.total-ep-canada.com
Touchstone Exploration www.touchstoneexploration.com
Value Creation Group www.vcrek.com

ASSOCIATIONS/ORGANIZATIONS

Alberta Chamber of Resources www.acr-alberta.com
Alberta Chambers of Commerce www.abchamber.ca
Alberta Energy www.energy.gov.ab.ca
Alberta Energy Regulator www.aer.ca
Alberta Environment and Parks www.aep.alberta.ca
Alberta Innovates www.albertainnovates.ca
Alberta Innovation and Advanced Education www.eae.alberta.ca
Alberta's Industrial Heartland Association www.industrialheartland.com
Building Trades of Alberta www.buildingtradesalberta.ca
Canada's Oil Sands Innovation Alliance www.cosia.ca
Canadian Association of Geophysical Contractors www.cagc.ca
Canadian Association of Petroleum Producers www.capp.ca
Canadian Heavy Oil Association www.choa.ab.ca
In Situ Oil Sands Alliance www.iosa.ca
Lakeland Industry & Community Association www.lica.ca
Natural Resources Conservation Board www.nrcb.ca
Oil Sands Community Alliance www.oscaalberta.ca
Oil Sands Secretariat www.energy.alberta.ca
Petroleum Technology Alliance Canada www.ptac.org

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